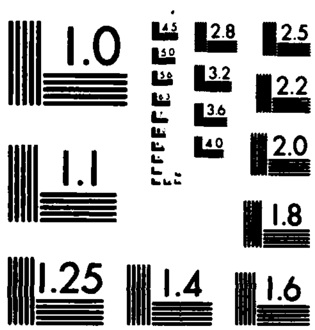
AD-A127 844 OPERATIONS MODELING FOR ARMY MOBILIZATION(U) 1/1
CONSTRUCTION ENGINEERING RESEARCH LAB (ARMY) CHAMPAIGN
IL S D HOTTMAN ET AL. MAR 83 CERL-SR-N-148

UNCLASSIFIED F/G 9/2 NL

END
DATE
FILMED
DTIC



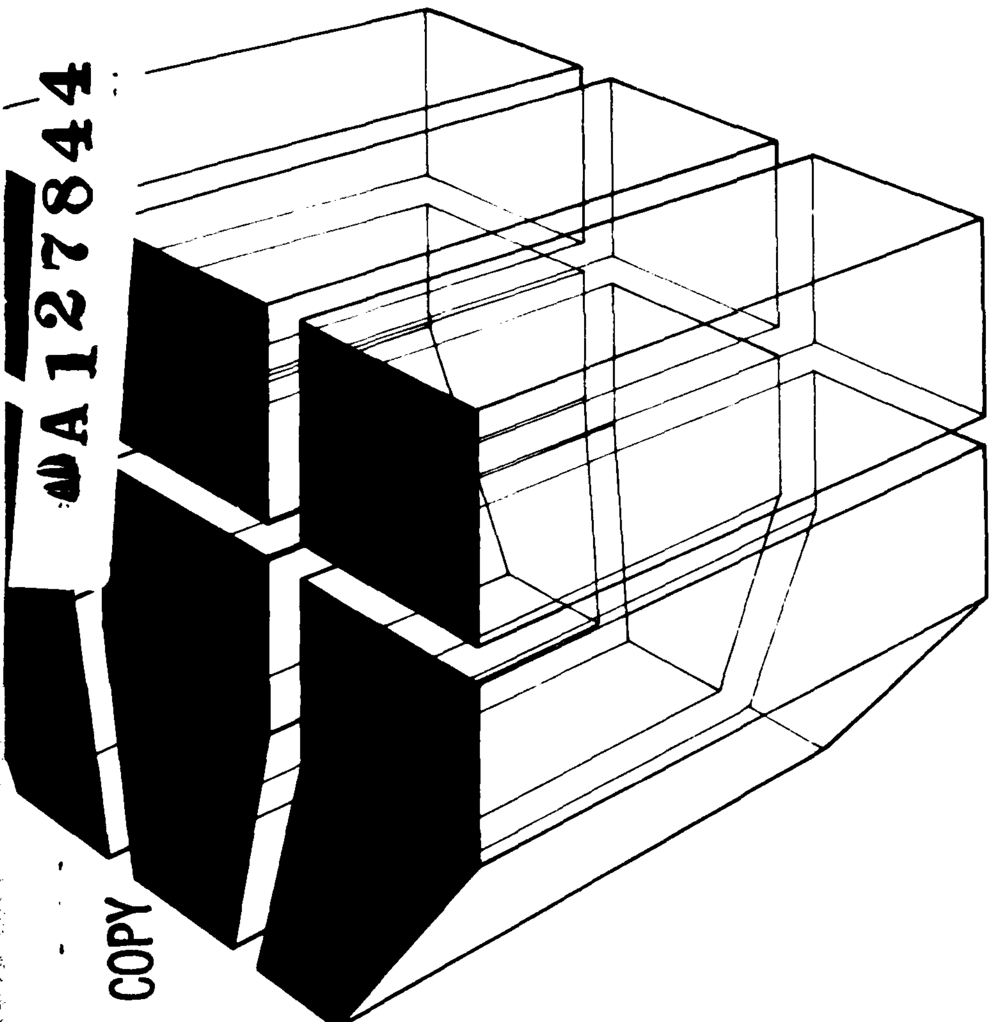
MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

construction engineering research laboratory

United States Army Corps of Engineers
...Serving the Army
...Serving the Nation

Special Report N-148
March 1983

OPERATIONS MODELING FOR ARMY MOBILIZATION



by
Steven Hottman
James Johnson
John Fittipaldi
Harold Balbach

CERL

Approved for public release; distribution unlimited.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE

READ INSTRUCTIONS BEFORE COMPLETING FORM

1. REPORT NUMBER CERL-SR-N-148	2. GOVT ACCESSION NO. AD-A127 844	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) OPERATIONS MODELING FOR ARMY MOBILIZATION		5. TYPE OF REPORT & PERIOD COVERED FINAL
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Steven D. Hottman, John J. Fittipaldi James H. Johnson Harold E. Balbach		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS US Army Construction Engineering Research Laboratory P.O. Box 4005 Champaign, IL 61820		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS GEFAE 115400106
11. CONTROLLING OFFICE NAME AND ADDRESS		12. REPORT DATE March 1983
		13. NUMBER OF PAGES 14 pages
14. MONITORING AGENCY NAME & ADDRESS(if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for public release; distribution unlimited.

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

Copies are obtainable from the National Technical Information Service
Springfield, VA 22151

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Mobilization Facilities Planning System
mobilization

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report describes the Pilot Mobilization Facilities Planning System (MFPS) developed by the U.S. Army Construction Engineering Research Laboratory. ~~(CERL).~~ The Pilot MFPS was developed to demonstrate how the scope and flexibility of the mobilization planning process can be widened using computerized modeling techniques.

(Cont'd)

DD FORM 1 JAN 73 1473 EDITION OF 1 NOV 65 IS OBSOLETE

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

The MFPS is designed to operate on a micro- or minicomputer resident at commands involved in mobilization planning. It is user-friendly and its software is portable. Because the system resides where it is being used, long distance data-transfer communication problems are avoided and users have direct control over database loading and manipulation.

FOREWORD

This study was performed for the Headquarters, U.S. Army Training and Doctrine Command (TRADOC), under Reimbursable Order GEFAE 115400106. Mr. Ray Spunzo, Chief of the Construction Directorate, and Mr. Lee Aikin, Chief of the Environment and Natural Resources Division, were the Technical Monitors. MAJ James Shamblen, MAJ Charles Clinger, and Mr. Phil Huber, also of TRADOC, coordinated significant phases of the study.

The material presented in this report is derived from a presentation delivered to a symposium sponsored by the Society for Computer Simulation, "Modeling and Simulating Microcomputers," held January 28 and 29, 1982, in San Diego, CA. The work was performed by the Environmental (EN) and Facility Systems (FS) Divisions of the U.S. Army Construction Engineering Research Laboratory (CERL), and by Analysis and Technology Inc. (A&T) of North Stonington, CT. The Mobilization Facilities Planning Systems (MFPS) Development Study was conducted by CERL-EN under the general supervision of Dr. Harold Balbach, Principal Investigator, and Dr. Ravinder K. Jain, Chief of CERL-EN, and supported by CERL-FS under Mr. James Johnson and Mr. Edward Lotz, Chief of CERL-FS. Mr. Richard Gauthier was A&T project engineer and was responsible for developing the program. In addition to the authors, Ms. Aileen Renta-Babb of CERL-EN and Mr. Scott MacArthur of CERL-FS assisted in important phases of this work. Appreciation also is expressed to Ms. Mary Scala of the CERL Support Office for her help in writing this report.

COL Louis J. Circeo is Commander and Director of CERL, and Dr. L. R. Shaffer is Technical Director.

CONTENTS

		Page
	DD FORM 1473	1
	FOREWORD	3
1	INTRODUCTION	5
	Background	
	Objective	
	Approach	
2	MFPS: FUNCTIONAL REQUIREMENTS	6
	Basic System Requirements	
	Overall Development Approach	
	The Pilot MFPS	
	Pilot Test Description	
	Pilot System Hardware	
	Pilot System Software	
	Planned System Enhancements	
3	CONCLUSIONS	11
	DISTRIBUTION	

OPERATIONS MODELING FOR ARMY MOBILIZATION

1 INTRODUCTION

Background

Without a flexible, reliable mobilization strategy, the Army cannot respond effectively to an outside threat to the nation's security or to a national emergency. During a mobilization crisis, thousands of troop units and their associated equipment (including armor, artillery, and helicopters) will have to be deployed or reassigned rapidly, often within hours.

To plan realistically for mobilization, the Army must know exactly how many troops each of its installations can house, feed, train, and prepare for deployment at any given time. Most important, the Army must be able to predict the performance of processes and facilities vital to successful mobilization, so problems can be identified and solutions developed.

Each Army command headquarters and installation maintains a mobilization plan which reflects how each individual command or installation can participate in an Army-wide mobilization crisis. Although these plans are updated regularly, the updating is done manually. To investigate if the mobilization planning might be improved via a computer-based system, the U.S. Army Training and Doctrine Command (TRADOC) asked the U.S. Army Construction Engineering Research Laboratory (CERL) to develop an automated mobilization planning system.

Objective

The objective of this study was to develop and demonstrate a pilot computer-aided Mobilization Facilities Planning System (MFPS) and to identify key factors for consideration in mobilization planning.

Approach

1. Identify facilities and capabilities vital to the support of mobilization.

2. Collect and aggregate data on the key facilities identified in Step 1 (including data on the projected demand on those facilities) into a computer database.

3. Based on the information gathered during Step 2, develop a computer program (including algorithms to relate facilities to their demands) that can be used to indicate feasible troop movements against limited resources and time factors.

4. Develop and demonstrate a Pilot MFPS.

2 MFPS: FUNCTIONAL REQUIREMENTS

The effects of troop movements on the loading of installation facilities must be anticipated at the earliest stages of mobilization planning. To support mobilization properly, the Army must know exactly where and when shortfalls will occur in such key facilities as housing, utilities, training capabilities, and medical services. Thus, the Army must have a facility status-reporting and requirements system that is reliable, rapid, and contingency-oriented. This is the role of the MFPS.

The MFPS is a *demand/supply comparison* system. The system produces status and requirements data that the Army can use to define feasible or advantageous troop movements and to identify factors which limit the abilities of key military and civilian facilities. It is designed as a planning and facilities scheduling aid, not a decision-making device. As an effective indication of installation status and capabilities, users can manipulate database information to construct variations in any assigned scenario for determining responses to real or anticipated mobilization demands. Thus, the MFPS can model the effects of alternate mobilization scenarios within minutes, as opposed to the days required using manual-based modeling.

Another concept critical to the MFPS development is local control; i.e., the system must reside where it is being used. It must not be affected by long-distance communications problems. It should be updated and maintained by the command mobilization planners who rely on its output.

Basic System Requirements

Basic functional requirements for the MFPS are:

1. It must reside at the planning site on a stand-alone micro- or minicomputer (with preference given to existing or in-use systems).

2. It must be interactive and user-friendly.

3. It must be installation- and multi-installation-specific.

4. It must reflect the changes in assets and demands as a function of time.

5. It must produce results as graphs (for summary briefings) and as tables (for detailed analyses).

6. It must be versatile enough to allow newly identified factors to be added easily to its database and modeling capabilities.

Overall Development Approach

The Pilot MFPS was designed so its software could be verified on an available large computer system. Although the Pilot MFPS was developed on a large commercial computer system, its software was designed for use on mini- and microcomputers which can be expected to be available on specific sites (i.e., local control).

There are many advantages to low-cost, self-contained mini- and microcomputers. These devices are independent of often tenuous communication links and are well suited to the local control goal of the MFPS because they are easy for field commands and installations to house and maintain.

To insure the system is user-friendly, the MFPS input language is conversational English. Several self-teaching options are available, depending on the user's skill and system experience. The typical user was assumed to have neither prior experience with computers nor detailed knowledge of Army planning and facilities jargon. Up to four levels of explanation are available for each user response asked for by the system. Each level has more detail about a response than the one preceding it. If a user gives an incorrect response, the system will suggest the user ask for "..HELP." HELPfiles explain, in detail, what the user needs to do to answer the system's questions correctly.

The database is installation-specific. A particular installation's facilities and other assets (e.g., utilities) plus its planned mobilization troop movements and other demands are grouped. Because the algorithms linking assets and demands reside in the database, equations can be refined during routine data update, without modifying the software.

The algorithm constants also reside in the database. Thus, asset and demand parameters can be modified globally during any single modeling run. That is, once a user changes a constant (e.g., changing a space allowance for a trainee billet from 72 to 65 sq ft), every equation using that constant during the rest of that particular modeling will reflect the change. Since each installation's database segment contains the algorithm constants for that installation, nonstandard attributes (e.g., climate extremes) are considered implicitly.

An installation's attributes are not arbitrarily specified as assets or demands in the database. They may be either or both. For instance, a given amount of barracks space can be considered an asset, but that barracks space is also a demand on the installation's utilities system. The MFPS design recognizes this dual role, and the system handles the situation routinely.

The results of a given modeling run may be presented as tables or graphs, or both. Tabular output is useful in planning activities where more precise results are needed. Histograms are used for overall scenario assessment or staff briefings. The graph output presents the same results as the tabular, but accents the time dependence of a particular scenario change.

The Pilot MFPS

Initial development of MFPS focused on a single key mobilization factor (housing), and a typical TRADOC installation (Fort Leonard Wood, MO). The Pilot MFPS ran on a commercial dial-up IBM system in FORTRAN 77. Line-printer graphics were used, although screen-graphics are anticipated for the final system. Terminal widths of 72 or 132 characters are available, and any number and mix of weeks from 1 to 157 (Mobilization weeks 0 through 156) may be requested.

The Fort Leonard Wood database contained asset information taken from the Integrated Facilities System (IFS) report, Fort Leonard Wood's proposed mobilization construction request, and the Nonindustrial Facility Use (NIF) projections (i.e., civil). Demand information was extracted from the mobilization plan, the Mobilization Table of Distribution and Allowance (MOBTDA), and the units' Tables of Organization and Equipment (TOE).

The pilot program was designed to model housing demand vs the installation's housing assets as a function of time.

Demands were in five categories:

1. Hospital patients

2. Trainees (basic and advanced)

3. Officers

4. General support force (training cadre, installation support, administration)

5. Deploying units (during assembly, training, and departure operations).

Housing assets were in six categories:

1. Pre-existing facilities

2. Diverted facilities

3. Field (tent camps and bivouacs)

4. Nonindustrial facilities (off-installation rentals)

5. Hasty construction

6. Programmed new military construction (semipermanent and permanent).

The program calculated events during a mobilization modeling session in mobilization (M) weeks -- from M+0 to M+157. The user could model all, or any part of this event calendar, e.g., from M+7 through M+13 or from M+5 to M+10.

Pilot Test Description

The test of the pilot system involved a user completely unfamiliar with the system, using only a single instruction sheet. The user was able to make simple modifications in demand, then assets, and finally combinations of the two for a complex scenario change. The results were as expected and verified by hand calculation. Graphic output format modifications requested by the user were noted and have now been implemented.

Pilot System Hardware

The developmental MFPS was transferred to and executed on a Wang 2200 VS, located at HQ-TRADOC, Fort Monroe, VA. This single computer outputs to several video terminals and printers. Its central processing unit has 512 K bytes of memory. Two 90-megabyte disc drives and a nine-track tape drive provide mass storage. A line printer and a controller link its various terminals. A Tektronix 4054 Graphic Display system has been added, with electrostatic and eight-color, pen-plotter output.

Sequential disk data files were used for security and to record usage levels. The security file restricts access to the computer code and database. The usage file automatically monitors the level of program use, so high usage times and inefficient code can be detected.

Data is stored via a random access disk file, to allow easy and frequent access to the database.

Pilot System Software

The Pilot MFPS software used, in part, a program developed by CERL for an environmental management modeling system. This software, and the MFPS-specific modifications, allows multilevel addressing which accommodates a predefined data structure. Only two routines give actual access to the database (one for reading and one for writing), so the software is very portable.

The Wang version code is written in FORTRAN, with some BASIC for operating system routine calls.

Planned System Enhancements

Code has been written to include all TRADOC installations in the housing version of MFPS. Planned enhancements to the system include:

a. Utilities

b. Training capability and facilities

c. Support capability and facilities

d. Medical facilities.

Other concerns can and will be added as the system's utility is recognized and the user community grows.

3 CONCLUSION

The scope and flexibility of mobilization planning can be widened by adapting computerized modeling techniques to the planning process.

The Pilot MFRS described in this report is designed to operate on a micro- or minicomputer resident at commands involved in mobilization planning. The system is user-friendly and system software is portable. Because the system resides where it is being used, long distance data-transfer communication problems are avoided and users have direct control over database loading and manipulation.

CERL DISTRIBUTION

Chief of Engineers
ATTN: Tech Monitor
ATTN: DAEN-ASI-L (2)
ATTN: DAEN-CCP
ATTN: DAEN-CW
ATTN: DAEN-CWE
ATTN: DAEN-CWM-R
ATTN: DAEN-CWO
ATTN: DAEN-CWP
ATTN: DAEN-EC
ATTN: DAEN-ECC
ATTN: DAEN-ECE
ATTN: DAEN-ZCF
ATTN: DAEN-ECB
ATTN: DAEN-RD
ATTN: DAEN-RDC
ATTN: DAEN-RDM
ATTN: DAEN-RM
ATTN: DAEN-ZCZ
ATTN: DAEN-ZCE
ATTN: DAEN-ZCI
ATTN: DAEN-ZCM

FESA, ATTN: Library 22060

FESA, ATTN: DET III 79906

US Army Engineer Districts
ATTN: Library
Alaska 99501
Al Batin 09616
Albuquerque 87103
Baltimore 21203
Buffalo 14207
Charleston 29402
Chicago 60604
Detroit 48231
Far East 96301
Fort Worth 76102
Galveston 77550
Huntington 25721
Jacksonville 32232
Japan 96343
Kansas City 64106
Little Rock 72203
Los Angeles 90053
Louisville 40201
Memphis 38103
Mobile 36628
Nashville 37202
New England 02154
New Orleans 70160
New York 10007
Norfolk 23510
Omaha 68102
Philadelphia 19106
Pittsburgh 15222
Portland 97208
Riyadh 09038
Rock Island 61201
Sacramento 95814
San Francisco 94105
Savannah 31402
Seattle 98124
St. Louis 63101
St. Paul 55101
Tulsa 74102
Vicksburg 39180
Walla Walla 99362
Wilmington 28401

US Army Engineer Divisions
ATTN: Library
Europe 09757
Huntsville 35807
Lower Mississippi Valley 39180
Middle East 09038
Middle East (Rear) 22601
Missouri River 68101
North Atlantic 10007
North Central 60605
North Pacific 97208
Ohio River 45201
Pacific Ocean 96858
South Atlantic 30303
South Pacific 94111
Southwestern 75202

US Army Europe
HQ, 7th Army Training Command 09114
ATTN: AETTG-DEH (5)
HQ, 7th Army ODCS/Engr. 09403
ATTN: AEAEN-EH (4)
V. Corps 09079
ATTN: AETVDEH (5)
VII. Corps 09154
ATTN: AETSDEH (5)
21st Support Command 09325
ATTN: AEREH (5)
Berlin 09742
ATTN: AEBA-EN (2)
Southern European Task Force 09168
ATTN: AESE-ENG (3)
Installation Support Activity 09403
ATTN: AEUES-RP

8th USA, Korea
ATTN: EAFE (8) 96301
ATTN: EAFE-Y 96358
ATTN: EAFE-ID 96224
ATTN: EAFE-4M 96208

8th USA, Korea
ATTN: EAFE-H 96271
ATTN: EAFE-P 96259
ATTN: EAFE-T 96212

ROK/US Combined Forces Command 96301
ATTN: EUSA-HHC-CFC/Engr

USA Japan (USARJ)
Ch, FE Div, AJEN-FE 96343
Fac Engr (Honshu) 96343
Fac Engr (Okinawa) 96331

Rocky Mt. Area 80903

Area Engineer, AEDC-Area Office
Arnold Air Force Station, TN 37389

Western Area Office, CE
Vanderberg AFB, CA 93437

416th Engineer Command 60623
ATTN: Facilities Engineer

US Military Academy 10996
ATTN: Facilities Engineer
ATTN: Dept of Geography & Computer Science
ATTN: DSCPER/MAEN-A

Engr. Studies Center 20315
ATTN: Library

AMMRC, ATTN: DRXMR-WE 02172

USA ARRCOM 61299
ATTN: DRCIS-RI-I
ATTN: DRSAR-IS

DARCOM - Dir., Inst., & Svcs.
ATTN: Facilities Engineer
ARRADCOM 07801
Aberdeen Proving Ground 21005
Army Matls. and Mechanics Res. Ctr.
Corpus Christi Army Depot 78419
Harry Diamond Laboratories 20783
Dugway Proving Ground 84022
Jefferson Proving Ground 47250
Fort Monmouth 07703
Letterkenny Army Depot 17201
Natick R&D Ctr. 01760
New Cumberland Army Depot 17070
Pueblo Army Depot 81001
Red River Army Depot 75501
Redstone Arsenal 35809
Rock Island Arsenal 61299
Savanna Army Depot 61074
Sharpe Army Depot 95331
Seneca Army Depot 14541
Tobyhanna Army Depot 18466
Tooele Army Depot 84074
Watervliet Arsenal 12189
Yuma Proving Ground 85364
White Sands Missile Range 88002

DLA ATTN: DLA-WI 22314

FORSCOM
FORSCOM Engineer, ATTN: AFEN-FE
ATTN: Facilities Engineer
Fort Buchanan 00934
Fort Bragg 28307
Fort Campbell 42223
Fort Carson 80913
Fort Devens 01433
Fort Drum 13601
Fort Hood 76544
Fort Indiantown Gap 17003
Fort Irwin 92311
Fort Sam Houston 78234
Fort Lewis 98433
Fort McCoy 54656
Fort McPherson 30330
Fort George G. Meade 20755
Fort Ord 93941
Fort Polk 71459
Fort Richardson 99505
Fort Riley 66442
Presidio of San Francisco 94129
Fort Sheridan 60037
Fort Stewart 31313
Fort Wainwright 99703
Vancouver Bks. 98660

HSC
ATTN: HSLO-F 78234
ATTN: Facilities Engineer
Fitzsimons AMC 80240
Walter Reed AMC 20012

INSCOM - Ch, Instl. Div.
ATTN: Facilities Engineer
Arlington Hall Station (2) 22212
Vint Hill Farms Station 22186

MDW
ATTN: Facilities Engineer
Cameron Station 22314
Fort Lesley J. McNair 20319
Fort Myer 22211

MTMC
ATTN: MTMC-SA 20315
ATTN: Facilities Engineer
Oakland Army Base 94626
Bayonne MOT 07002
Sunny Point MOT 28461

NARADCOM, ATTN: DRDNA-F 071160

TARCOM, Fac. Div. 48090

TRADOC
HQ, TRADOC, ATTN: ATEN-FE
ATTN: Facilities Engineer
Fort Belvoir 22060
Fort Benning 31905
Fort Bliss 79916
Carlisle Barracks 17013
Fort Chaffee 72902
Fort Dix 08640
Fort Eustis 23604
Fort Gordon 30905
Fort Hamilton 11252
Fort Benjamin Harrison 46216
Fort Jackson 29207
Fort Knox 40121
Fort Leavenworth 66027
Fort Lee 23801
Fort McClellan 36205
Fort Monroe 23651
Fort Rucker 36362
Fort Sill 73503
Fort Leonard Wood 65473

TSARCOM, ATTN: STSAS-F 63120

USACC
ATTN: Facilities Engineer
Fort Huachuca 85613
Fort Ritchie 21719

WESTCOM
ATTN: Facilities Engineer
Fort Shafter 96858
ATTN: APEN-IM

SHAPE 09055
ATTN: Survivability Section, CCB-OPS
Infrastructure Branch, LANDA

HQ USEUCOM 09128
ATTN: ECJ 4/7-LOE

Fort Belvoir, VA 22060
ATTN: ATZA-DTE-EM
ATTN: ATZA-DTE-SW
ATTN: ATZA-FE
ATTN: Engr. Library
ATTN: Canadian Liaison Office (2)
ATTN: IWR Library

Cold Regions Research Engineering Lab 03755
ATTN: Library

ETL, ATTN: Library 22060

Waterways Experiment Station 39180
ATTN: Library

HQ, XVIII Airborne Corps and 28307
Ft. Bragg
ATTN: AFZA-FE-EE

Chanute AFB, IL 61868
3345 CES/DE, Stop 27

Norton AFB 92409
ATTN: AFRCE-MX/DEE

Tyndall AFB, FL 32403
AFESC/Engineering & Service Lab

NAFEC
ATTN: RDT&E Liaison Office
Atlantic Division 23511
Chesapeake Division 20374
Southern Division 29411
Pacific Division 96860
Northern Division 19112
Western Division 64066
ATTN: Sr. Tech. FAC-03T 22332
ATTN: Asst. CDR R&D, FAC-03 22332

NCEL 93041
ATTN: Library (Code L08A)

Defense Technical Info. Center 22314
ATTN: DDA (12)

Engineering Societies Library 10017
New York, NY

National Guard Bureau 20310
Installation Division

US Government Printing Office 22304
Receiving Section/Depository Copies (2)

268
1-83

Operations modeling for Army mobilization / by Steven D. Hottman... (et al.) -
Champaign, IL : Construction Engineering Research Laboratory ; available
from NTIS, 1983.
V. (Special report / Construction Engineering Research Laboratory ;
N-148) Derived from a presentation at a symposium Modeling and simulating micro-
computers, Jan 1982, San Diego.

1. Mobilization. I. Hottman, Steven D. II. Johnson, James H. III.
Balbach, Harold E. IV. Fittipaldi, John J. V. Series. Special report
(Construction Engineering Research Laboratory) ; N-148.